(2) Load and Stress Calculations of Wave Washer

If the Wave Washer is assumed to be a continuous beam, the following formulas are given:

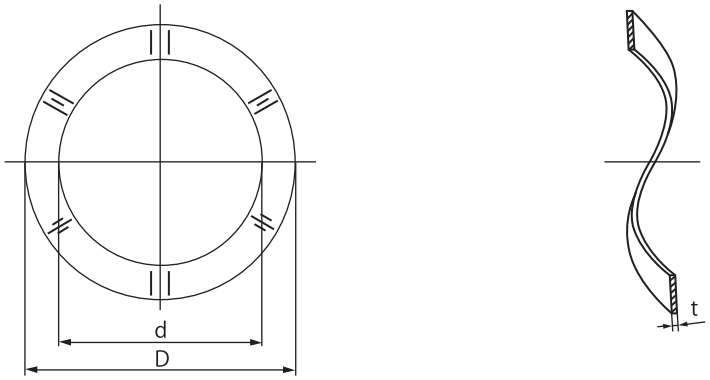

Fig. 3 Wave washer

Load

$$P = \frac{16Eb\ t^3 N^4 \delta}{\pi^3 D_m^3} \quad (3)$$

Stress

$$S = \frac{0.75\ \pi P D_m}{b t^2 N^2} \quad (4)$$

P : Load (N)
S : Stress (N/ mm²)
D : Diameter of outer periphery (mm)
d : Diameter of inner periphery (mm)
D_m : Average diameter (mm)〔=(D+d)/2〕
b : Rim width (mm)〔=(D−d)/2〕
t : Plate thickness (mm)
N : Number of waves
δ : Amount of deflection (mm)
E : Longitudinal elastic modulus (N/ mm²) Table 1
π : Circumference ratio

Reference for design

- To change the load by a large amount:
  Adjust the plate thickness and the number of waves.
  The load is proportional to the second power of the plate thickness and to the fourth power of the number of waves.
  (However, settling will arise if the number of waves is increased. Therefore it is better not to adjust the number much.)
- To change the load by a small amount:
  Adjust the diameters of inner and outer peripheries (rim width). The load is proportional to the rim width.

Notes

There are differences between the calculated and measured values for the formula of deflection and load. Substitution of conditions such as diameters of outer and inner peripheries gives a first-order equation of deflection and load which is plotted as a straight line.
However, the actual load curve will not be a simple straight line but a curve.